SECTION [15470] [02675]

DISINFECTION OF WATER PIPING

****

Edit only bracketed portions of the text as required to suit project. Use 15470 when piping is on-site and within buildings. Use 02675 when piping is on-site only.

****

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disinfection requirements for the following new, repaired or modified systems:

1. Potable water distribution piping [on Project site and within buildings].

2. [Fire protection piping below grade to base of riser.]

B. Dechlorination procedures for chlorinated water discharges.

C. Discharge requirements (point of discharge and chlorine concentration).

D. [Note: Disinfection of non-potable water piping and fire protection piping downstream of alarm valve is not required.]

1.2 LANL PERFORMED WORK

A. Water quality testing: LANL will perform water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality. LANL will approve use of disinfected piping when test results demonstrate compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.3.D.

1.3 DESCRIPTION

A. Disinfection Requirements

1. The Contractor will practice precautions to protect the interiors of pipes, fittings, and valves against contamination during construction.

a. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material.

b. All openings of the pipeline will be closed when pipe laying is stopped at end of the work day or for other reasons, such as rest breaks or meal periods.

2. Notify the Construction Inspector prior to any discharges as described in Section 1.3.C.

3. Do not disinfect any pipe until the source of potable water supply used for flushing and/or disinfection is approved by the Construction Inspector.

4. After successful hydrostatic testing, flush and disinfect water mains by AWWA C651, "Disinfecting Water Mains," using the “Continuous Feed Method” as described in Section 3.1.

5. Disinfect interior water piping as described in Section 3.2.

6. LANL will perform water quality testing of water samples taken from piping systems for chlorine concentrations and bacteriological quality as described in Section 1.3.E.

7. Do not place piping in service until notified by the Construction Inspector that the water quality test results are approved by LANL, as described in Section 1.3.D.

8. Reflush and retest disinfected potable water piping which has been allowed to stand stagnant for more than 30 days before being placed in service.

9. [Disinfect all piping within building with service taps and fixtures installed. Flow chlorinated water and flush water through all lavatories, sinks, drinking fountains, showers, and hose bibs.]

B. Dechlorination Requirements

1. Notify the Construction Inspector of any discharges as described in Section 1.3.C.

2. For discharge to the environment, dechlorinate applicable discharges with neutralizing agent to reduce total chlorine concentration to less than 1 mg/L (1 ppm) prior to discharge.

3. For discharge to the sanitary wastewater system, dechlorinate applicable discharges with neutralizing agent to reduce total chlorine concentration to less than 3 mg/L (3 ppm) prior to discharge.

4. For discharge to a National Pollution Discharge Elimination System (NPDES) permitted outfall, dechlorinate applicable discharges with neutralizing agent to reduce total chlorine concentration to less than the maximum chlorine concentration allowable of the particular outfall as described in the National Pollution Discharge Elimination System Permit No. NM0028355.

C. Discharge Requirements

1. Potable Water Used for Flushing and Line Disinfection

a. For requirements required of Contractor refer to Section 01325.

2. Chlorine Concentration Requirements of Discharge Water

a. Chlorinated waters used for disinfection must be dechlorinated prior to discharge as described in Section 3.4.

b. Waters may be discharged as follows:

1. Water discharged to the environment must have a total chlorine concentration of less than 1 mg/L (1 ppm).

a. For discharge of less than 5,000 gallons of dechlorinated water, notify the Construction Inspector at least 48 hours (2 working days) in advance of planned discharges.

b. For discharge of 5,000 gallons or more of dechlorinated water, notify the Construction Inspector at least 4 working days in advance of planned discharges.

2. Water discharged to the sanitary wastewater system must have a total chlorine concentration of less than 3 mg/L (3 ppm).

a. Notify the Construction Inspector at least 72 hours (3 working days) in advance of planned discharges to the sanitary wastewater system.

3. Water discharged to a National Pollution Discharge Elimination System (NPDES) permitted outfall must comply with all parameters of that particular outfall, including chlorine concentration, as described in the National Pollution Discharge Elimination System Permit No. NM0028355.

c. For discharge of chlorinated/dechlorinated water, notify the Construction Inspector, as described in Section 1.3.D, to arrange for a total chlorine concentration test.

3. Notify the Construction Inspector immediately in the event of any accidental discharge.

D. Water Quality Testing

1. Notify the Construction Inspector at least 48 hours (2 working days) in advance to arrange for a free or total chlorine concentration test.

2. Notify the Construction Inspector at least 48 hours (2 working days) in advance to arrange for a bacterial quality test.

3. Requirements for demonstration of compliance with water quality requirements of the Safe Drinking Water Act:

a. Total chlorine concentration of less than 1 mg/L (1 ppm).

b. The absence of any coliform bacteria.

c. Less than 200 noncoliform bacteria per 100 mL sample.

E. Notifications and Records Required of Construction Inspector

1. Discharge of Potable Water Used for Flushing and Line Disinfection

a. Refer to Section 01325.

2. Water Quality Testing

a. The Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for a total chlorine concentration test.

b. The Construction Inspector will notify the Contract SDWA Compliance Laboratory (667-0105) at least 24 hours (1 working day) in advance to arrange for a bacterial quality test.

PART 2 CHEMICAL PRODUCTS

2.1 MATERIAL SAFETY DATA SHEETS

A. Material Safety Data Sheets for all chemical products, including disinfection and dechlorination products, must be maintained on site by the Contractor.

2.2 ACCEPTABLE DISINFECTANTS

A. Sodium hypochlorite solution (bleach) contains approximately 5 percent to 15 percent available chlorine. Care must be used in control of conditions and length of storage to minimize its deterioration.

B. Calcium hypochlorite (HTH) granules contain approximately 65 percent available chlorine by weight. HTH will not readily dissolve in water with a temperature of less than 41^{o}F (5^{o}C). HTH should be stored in a cool, dry, and dark environment to minimize its deterioration. Direct placement of solid phase HTH into piping is not permitted.

C. Disinfection with chlorine gas or liquid is not permitted.

2.3 ACCEPTABLE NEUTRALIZING AGENTS

A. Use sodium thiosulfate (technical grade, prismatic rice) as the neutralizing agent.

B. Use of sulfur dioxide gas is not permitted.

2.4 PRECAUTIONS

A. Calcium hypochlorite (HTH) is corrosive and is a strong oxidizer. Reducing agents (*e.g.* sodium thiosulfate), concentrated acids, and organic compounds (e.g. antifreeze, gasoline), can oxidize, burn or explode if they come into contact with solid phase HTH.

B. Do not use calcium hypochlorite (HTH) on solvent-welded plastic pipe or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with HTH.

PART 3 EXECUTION

3.1 DISINFECTION OF NEW WATER MAINS BY THE CONTINUOUS-FEED METHOD

A. Preliminary flushing

1. Prior to disinfection, fill the main with water to eliminate air pockets.

2. Flush the main shall to remove particles. Notify the Construction Inspector prior to discharge of water from flushing as described in Section 1.3.C. The flushing velocity in the main shall not be less than 2.5 ft/s. Flush the new system until all foreign matter, debris, and discolored water is cleared. The following table shows the rates of flow required to produce a velocity of 2.5 ft/s in pipes of various sizes.

Nominal Pipe Size (in.)	Flow Required To Produce 2.5 ft/s (approx.) Velocity In Main (gpm)
4	100
6	200
8	400
10	600
12	900
16	1600

3. Obtain verification from the Construction Inspector that the system has been thoroughly cleaned (flushed) and is ready for chlorination.

B. Chlorination of the main

1. Chlorinated water, with a free chlorine concentration of not less than 25 mg/L, shall enter the main at a point no more than 10 ft. downstream from the beginning of the new main. The Contractor will verify free chlorine concentration of not less than 25 mg/L by a primary free chlorine concentration test as described in Section 1.3.D.

2. Retain the chlorinated water in the main for at least 24 hours, during which time all valves and hydrants in the system shall be operated to ensure disinfection of the appurtenances.

3. At the end of the 24 hour period, the treated water in all portions of the main shall have a free chlorine concentration of not less than 10 mg/L. The Contractor will verify free chlorine concentration of not less than 10 mg/L by a secondary free chlorine concentration test as described in Section 1.3.D.

4. After the secondary free chlorine concentration test has been completed, flush the system with potable water until the total chlorine concentration in the main is less than 1 mg/L (1 ppm). Notify the Construction Inspector prior to discharge of water from disinfection of the main as described in Section 1.3.C.

5. After final flushing, contact the Construction Inspector to arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.3.D.

6. After the final total chlorine concentration and bacteriological quality tests have been completed, the Construction Inspector will furnish the disinfection report to the Contractor. If the water quality tests do not show compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.3.D, repeat 1, 2, 3, 4, and 5 until all test results demonstrate compliance.

3.2 DISINFECTION OF INTERIOR PIPING

A. No disinfection water with a total chlorine concentration greater than 1 mg/L (1 ppm) may be discharged to the environment.

B. If total quantity of chlorinated waters for disinfection is less than 100 gallons, disinfection water may be discharged directly to wastewater collection system without regard to chlorine concentration.

C. If total quantity of chlorinated water for disinfection is 100 gallons or more, disinfection water must be dechlorinated prior to discharge as described in Section 1.3.D.

D. Chlorination of piping

1. Use chlorinated water, with a free chlorine concentration of not less than 25 mg/L, for disinfection of interior piping. Verify free chlorine concentration of not less than 25 mg/L by a primary free chlorine concentration test as described in Section 1.3.D.

2. Retain the chlorinated water in the piping for at least 24 hours, during which time all lavatories, sinks, drinking fountains, showers, and hoses bibs shall be operated to ensure disinfection of the appurtenances.

3. At the end of the 24 hour period, the treated water in all portions of the piping shall have a free chlorine concentration of not less than 10 mg/L. The Contractor will verify free chlorine concentration of not less than 10 mg/L by a secondary free chlorine concentration test as described in Section 1.3.D.

4. After the secondary free chlorine concentration test has been completed, flush the system with potable water until the total chlorine concentration in the piping is less than 1 mg/L (1 ppm). Notify the Construction Inspector prior to discharge of water from disinfection of the interior piping as described in Section 1.3.C.

3.3 DISINFECTION FOR REPAIR AND/OR MODIFICATION OF EXISTING MAINS OR INTERIOR PIPING SYSTEMS

A. Prior to repair and/or modification of piping systems, disinfect any tools to be used for repair and/or modification.

B. Where practical, isolate a section of the affected line and shut off all service connections.

C. Flushing

1. Prior to disinfection, flush the affected line to clean out contamination introduced during repairs. Notify the Construction Inspector prior to discharge of water from flushing as described in Section 1.3.C. If possible, flush from both directions. Flush until discolored water is eliminated and the water flows clear. If the line segment cannot be isolated, thoroughly flush the segment through a tank or fire hydrant.

2. Obtain verification from the Construction Inspector that the affected line has been thoroughly cleaned (flushed) and is ready for chlorination.

D. Swab or spray the inside of all new pipe and fittings with a minimum of 1% (10,000 ppm) hypochlorite solution before they are installed.

E. Apply chlorine to water from the existing supply to expose all interior surfaces of the affected segment at the chlorine concentration and contact times as follows; verify total chlorine concentration by an initial total chlorine concentration test as described in Section 1.3.D:

Chlorine Concentration (mg/L,ppm)	Contact Time
300	15 minutes
250	1 hour
200	1.5 hours
150	2 hours
100	3 hours

F. Retain the chlorinated water in the main, or piping, for the above prescribed contact time. At the end of the prescribed time period, flush the affected line with potable water until the total chlorine concentration in the main is less than 1 mg/L (1 ppm). Notify the Construction Inspector prior to discharge of water as described in Section 1.3.D.

G. After flushing, contact the Construction Inspector to arrange for final total chlorine concentration and bacteriological quality tests as described in Section 1.3.D.

H. After the final total chlorine concentration and bacteriological quality tests have been completed, the Construction Inspector will furnish the disinfection report to the Contractor. If the water quality tests do not show compliance with water quality requirements of the Safe Drinking Water Act as described in Section 1.3.D, repeat E, F, and G above until all test results demonstrate compliance.

3.4 DECHLORINATION OF DISCHARGES

A. Sodium thiosulfate crystals may be applied manually or a liquid solution of sodium thiosulfate may be directly injected into the chlorinated water discharge pipe using a metering pump or venturi injector.

B. Provide a mixing tank to allow dechlorination of water prior to discharge.

C. The approximate dosage rate of sodium thiosulfate may be calculated from the following table:

Free Chlorine Residual Concentration	Sodium Thiosulfate ($Na_2S_20_2 * 5H_20$)
10 mg/L	1.2 lb/10,000 gal
50 mg/L	6.0 lb/10,000 gal
500 mg/L	60.0 lb/10,000 gal

D. Do not dose sodium thiosulfate beyond the minimum required to neutralize the chlorine actually present in the discharge.

END OF SECTION